

# Transformation of the Process Industries in Germany and Europe

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Klima Umwelt Energie

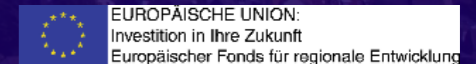
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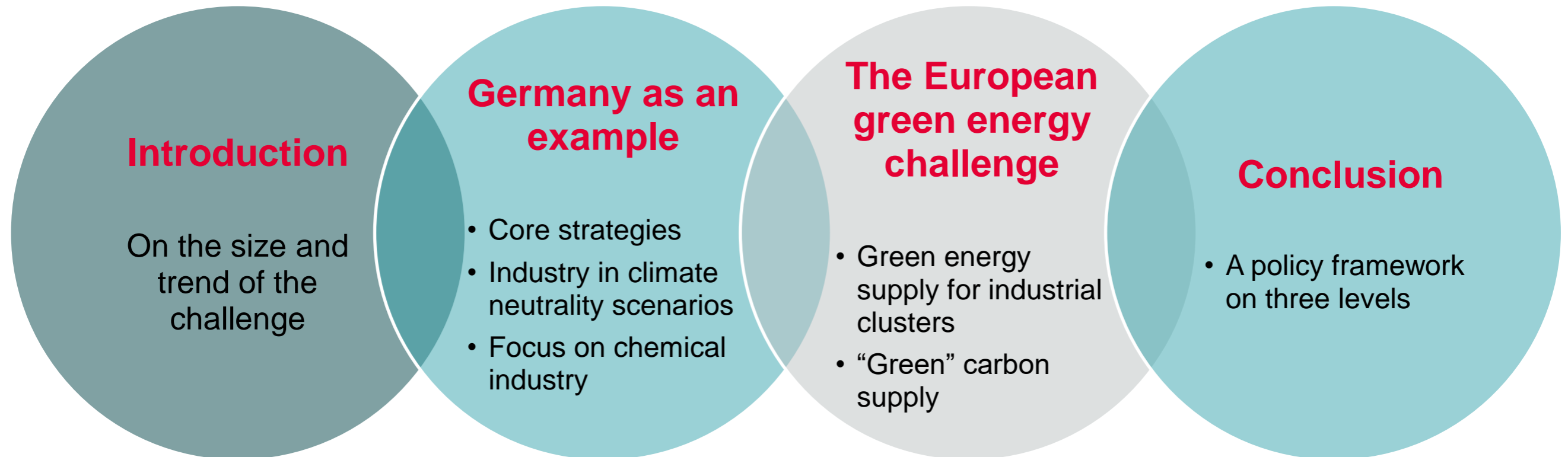


**Process<sup>4</sup>  
Sustainability**

**Cluster for climate-neutral  
process industries in Hesse**

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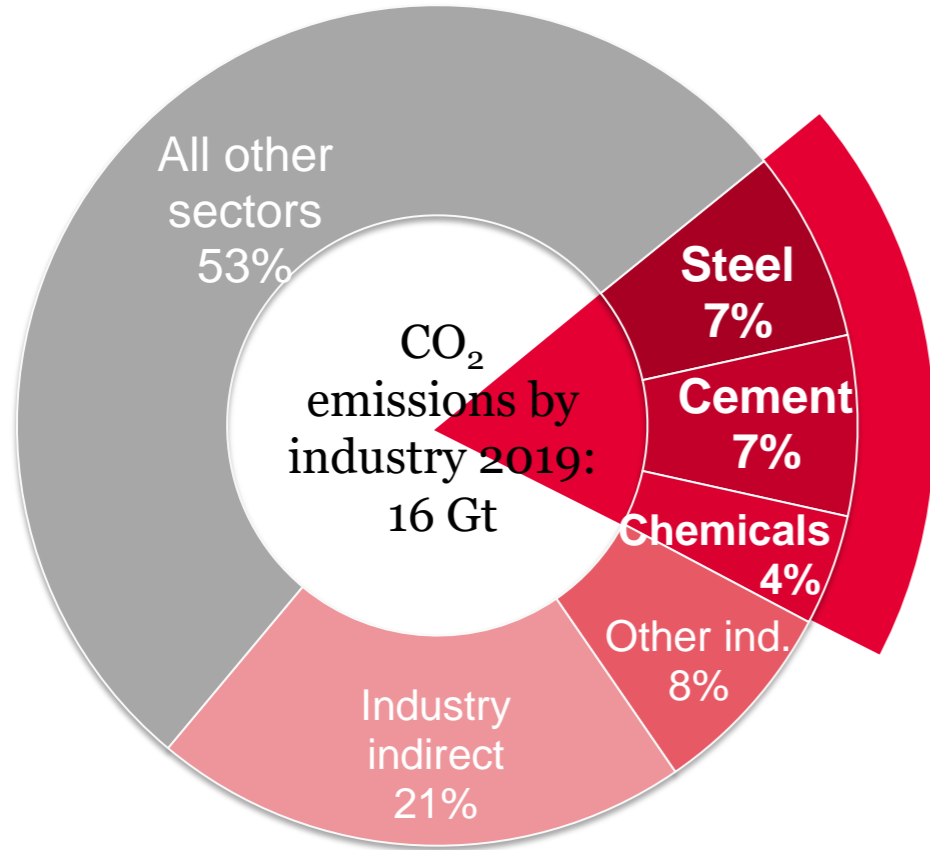




# The importance of materials processing industries?

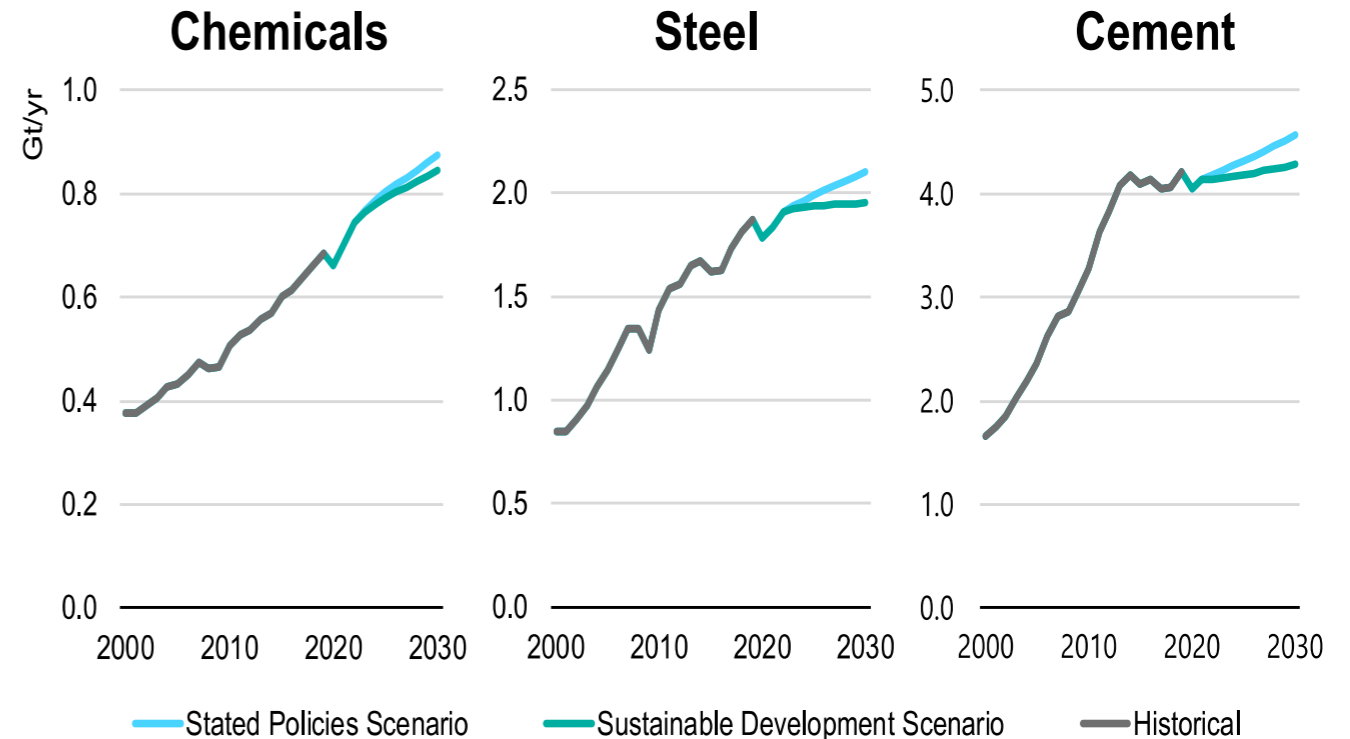
Material conversion is the most GHG intensive element of the material and the energy system

## 3 basic industries directly emit 19% of global energy related CO<sub>2</sub> emissions...



Source: own figure based on IEA ETP 2020 (4), data for 2019 (includes process emissions)

## ... and the demand for basic materials is expected to rise further (scenarios for 2030 by IEA)

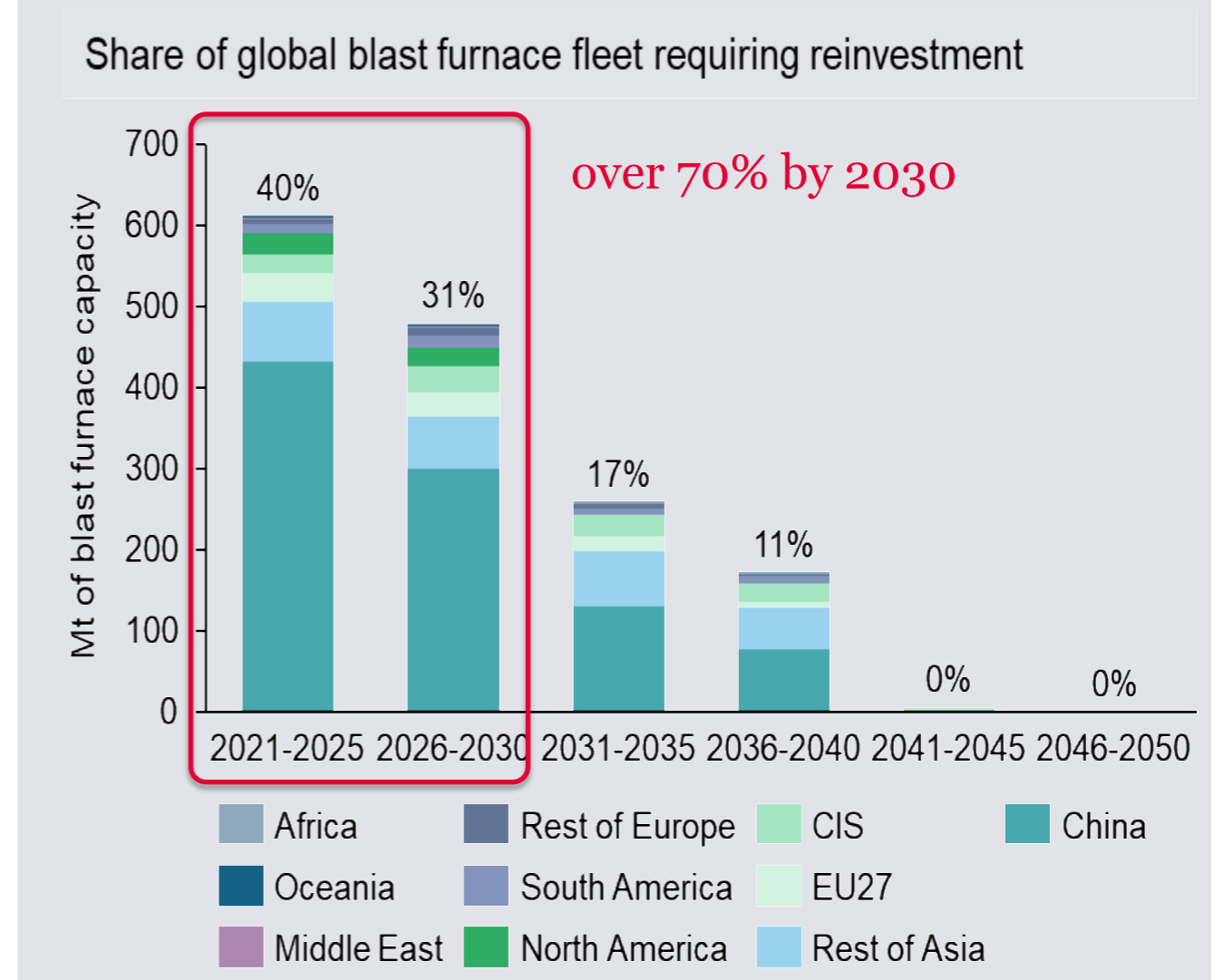
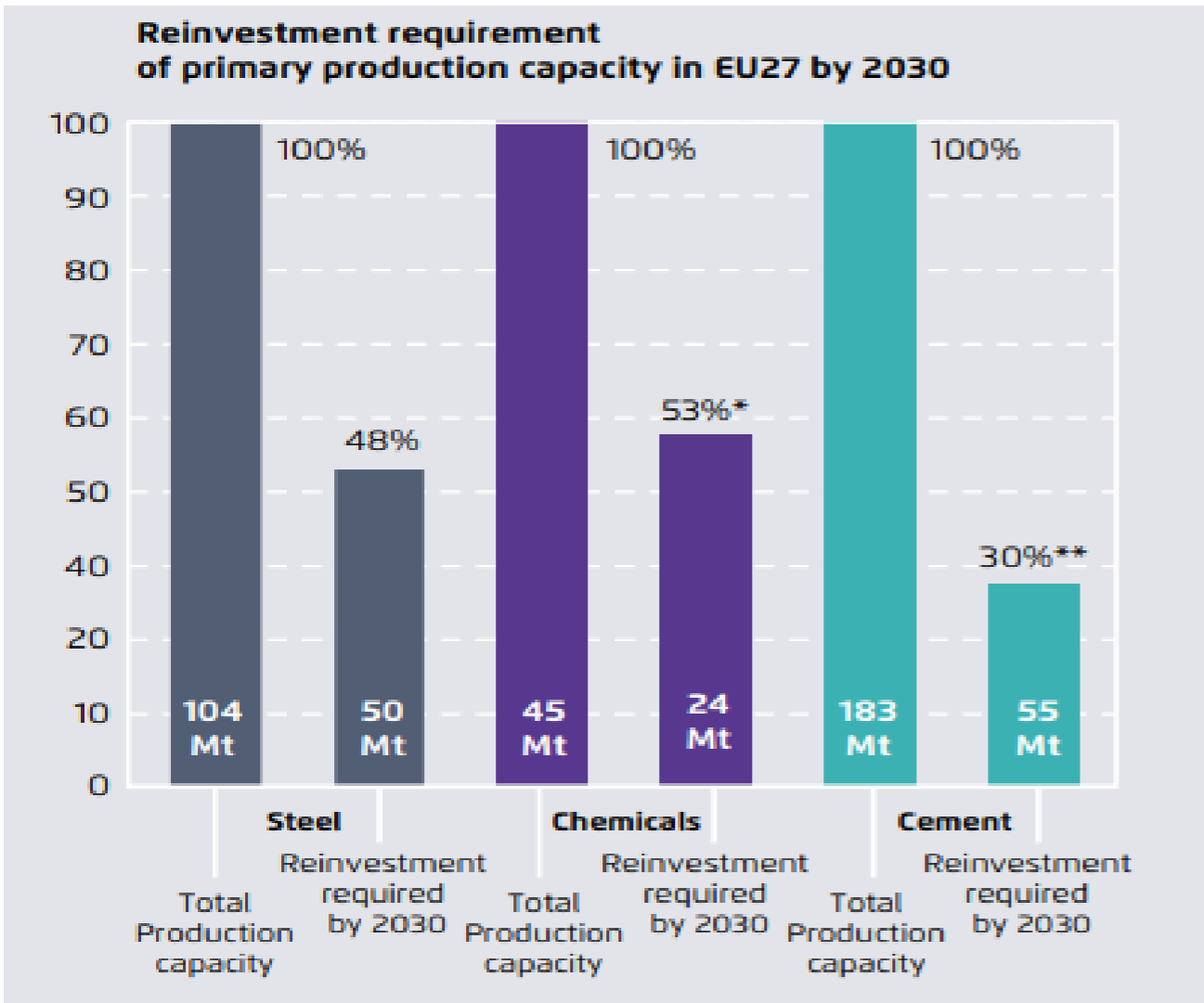


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Note: Chemicals includes the primary chemicals ethylene, propylene, and benzene, toluene, mixed xylenes, ammonia and methanol as an aggregate proxy for sector activity growth.

# Climate neutrality 2050 is only one investment cycle away: All investments from now on must be compatible with climate neutrality

## High need for reinvestment in European and Global heavy industries



# Germany as an example

A comparison of industry  
in recent climate neutrality  
scenarios

AGORA et al.



Ministry of Economy



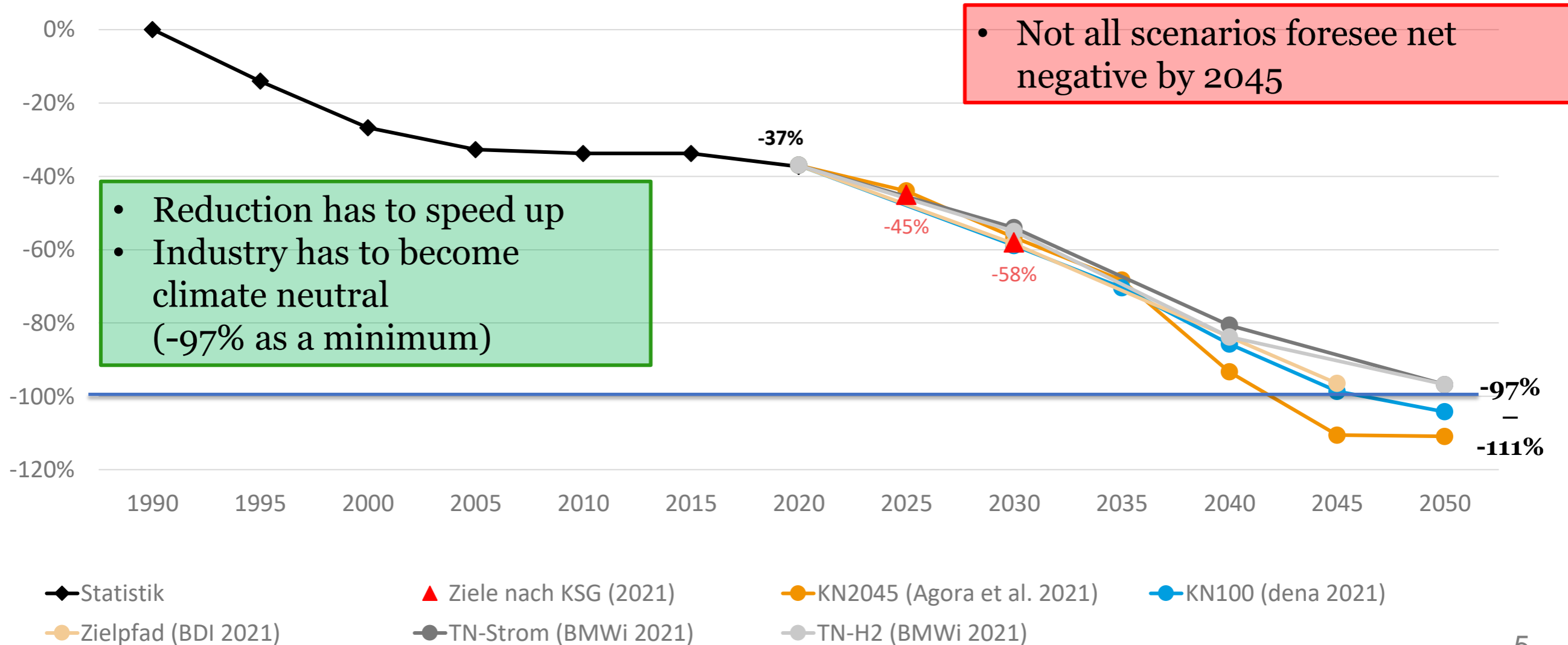
German Energy Agency



Assoc. of German Industry



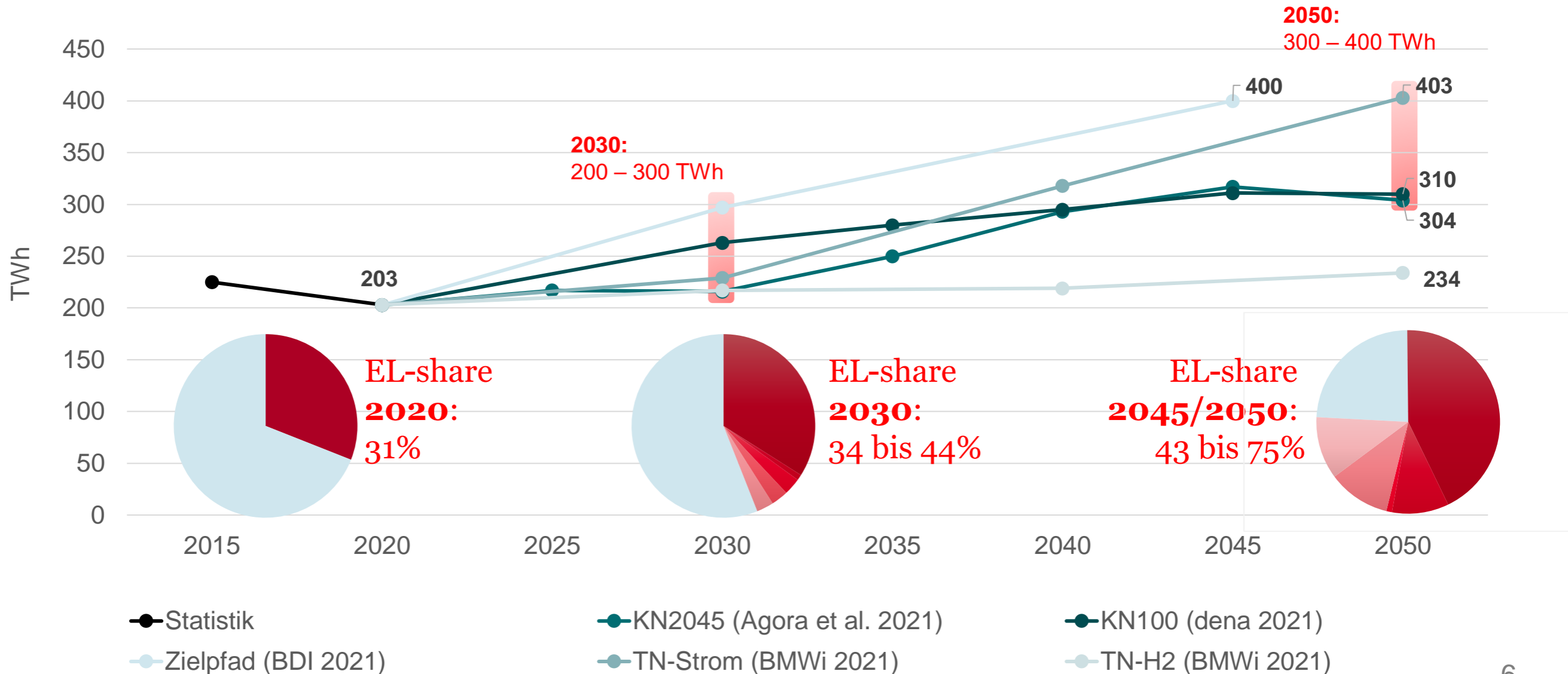
Reduction of industrial GHG emissions vs. 1990 – actual development and scenarios



# Industrial Electricity Use

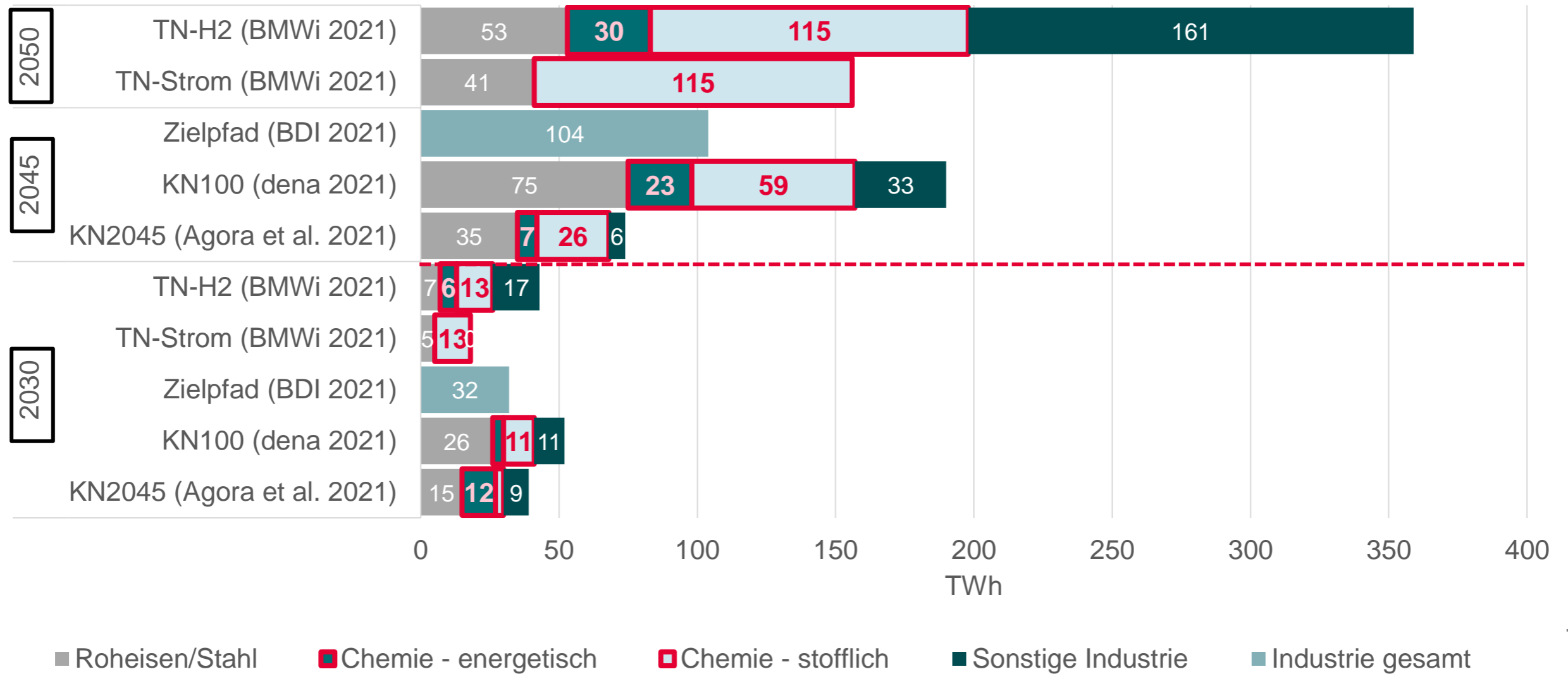
(without electricity used for H2 electrolysis)

Electricity becomes the dominating final energy in industry  
But we see a vast range between studies



# Hydrogen use in industry by sector

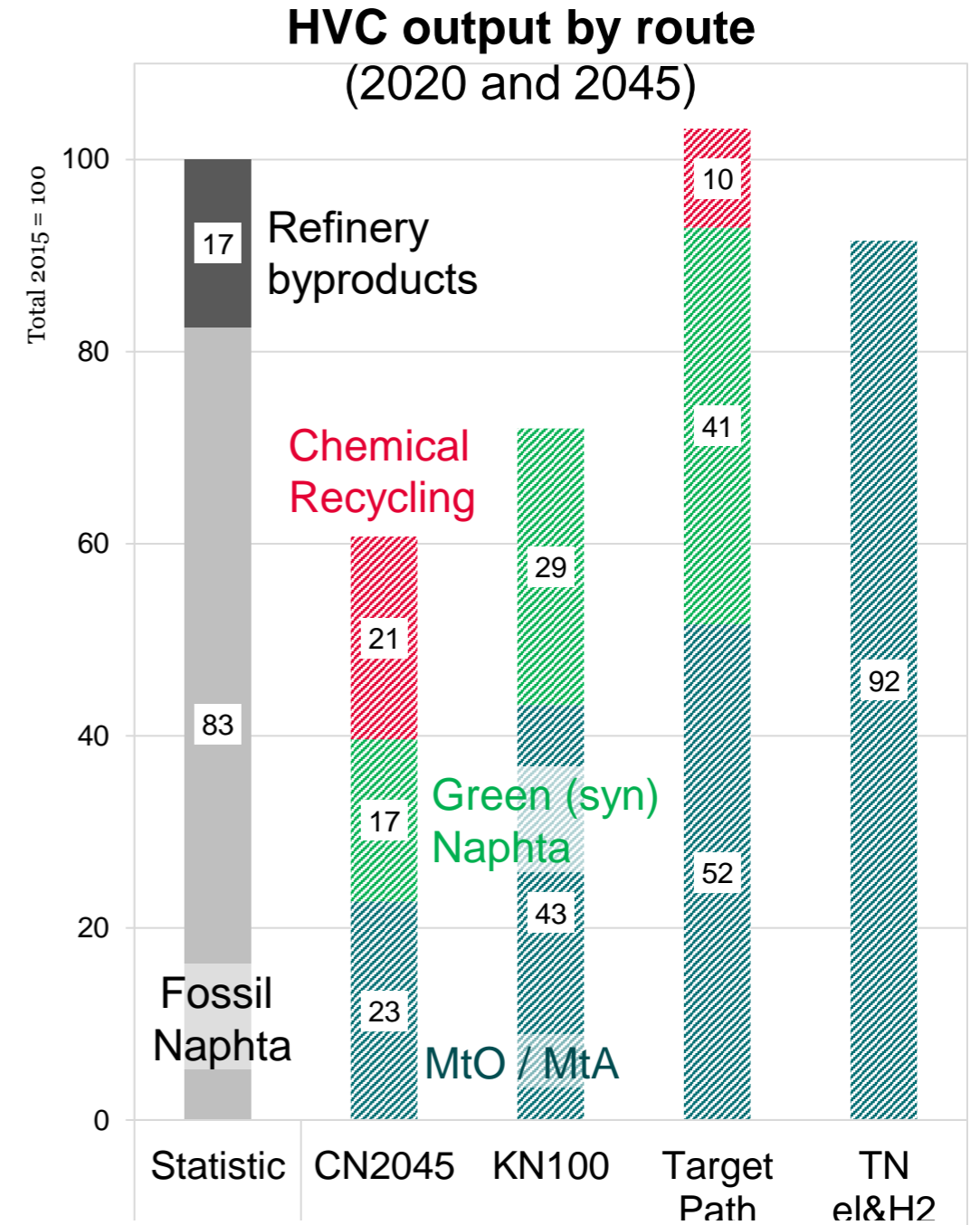
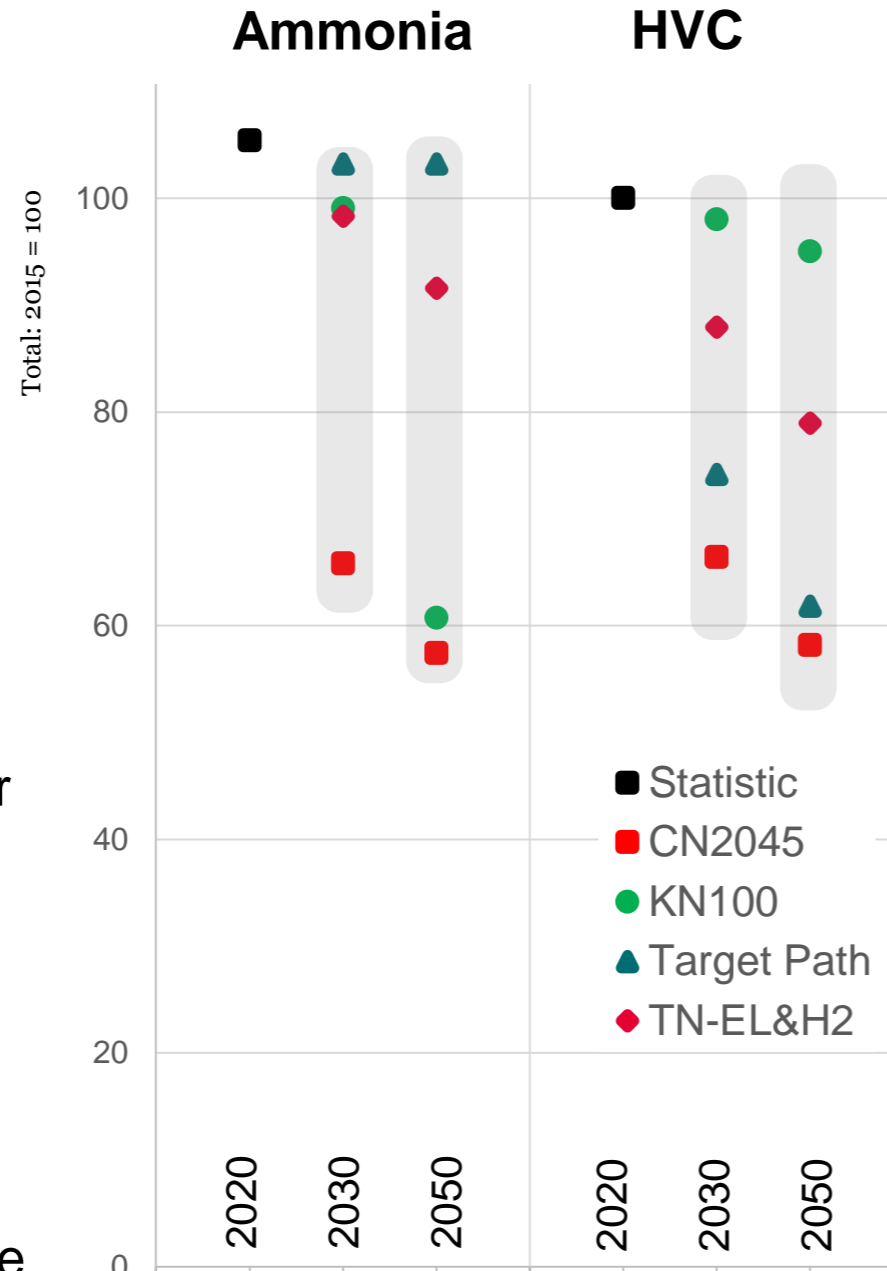
All studies see hydrogen necessary in steel industry and as a chemical feedstock  
But the amount of hydrogen use and all other uses are debated





## Production

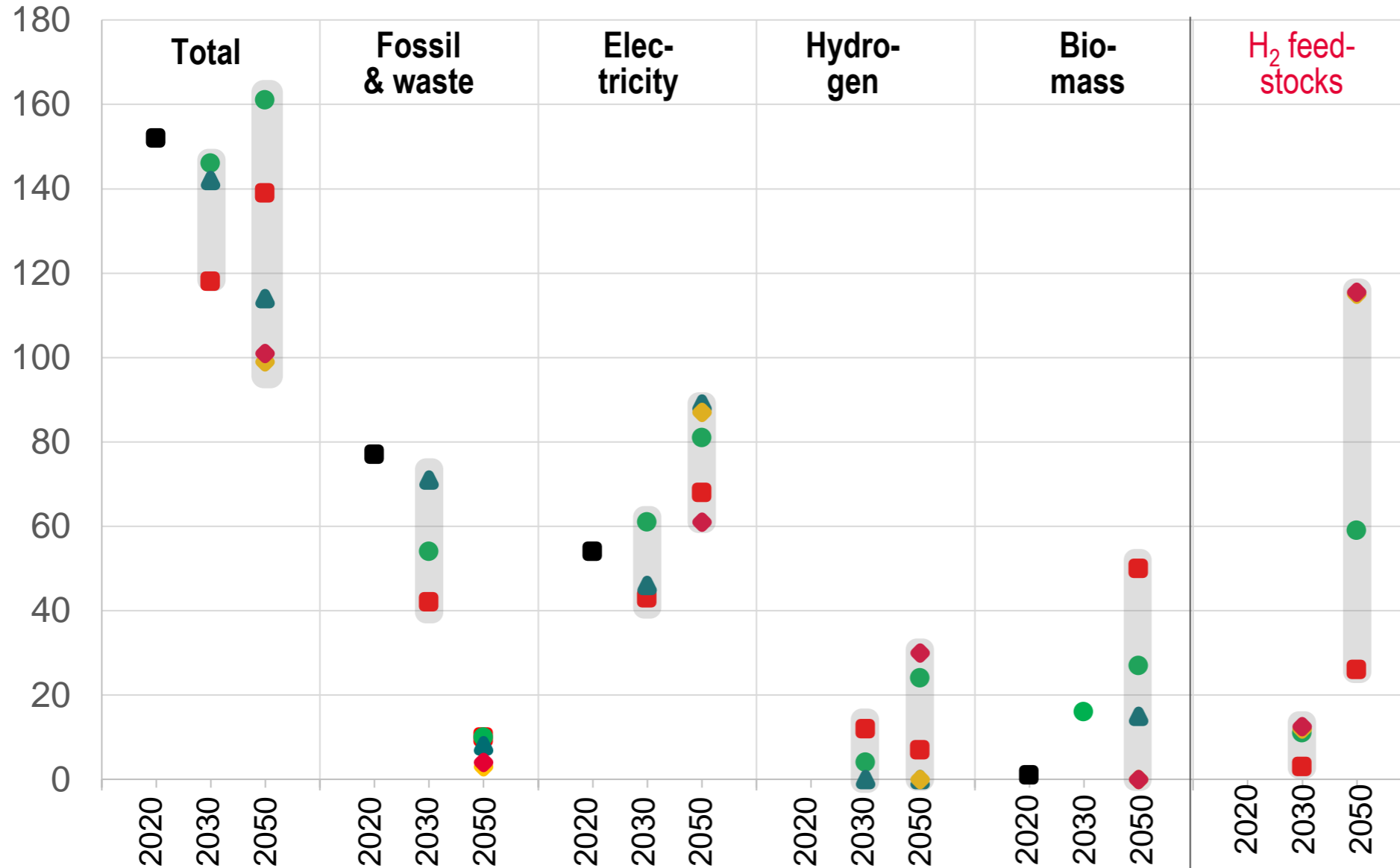
- Studies differ on production: Constant or strongly declining
- Complete phase out of fossil feedstocks
- Switch to synthetic feedstock (and waste)
- Studies strongly diverge on the routes



# Chemical industry in climate neutrality scenarios

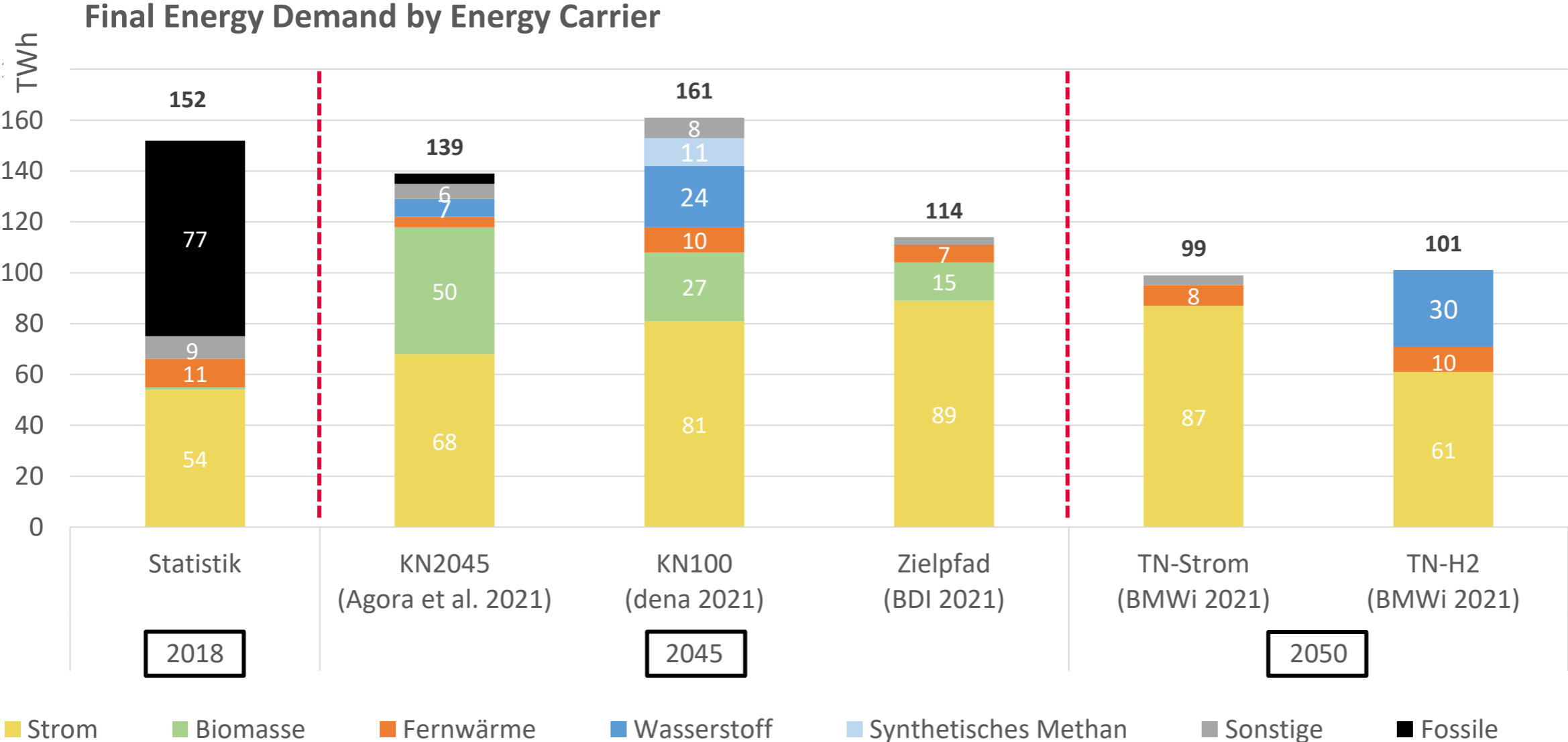
## Energy demand

Energy demand by fuel in TWh



- Fossil phase out at various speeds
- Increasing use of electricity and hydrogen (+ biomass?)
- Strong hydrogen use for feedstocks

- Statistic
- CN2045
- KN100
- ▲ Target Path
- TN-EL
- ◆ TN-H2



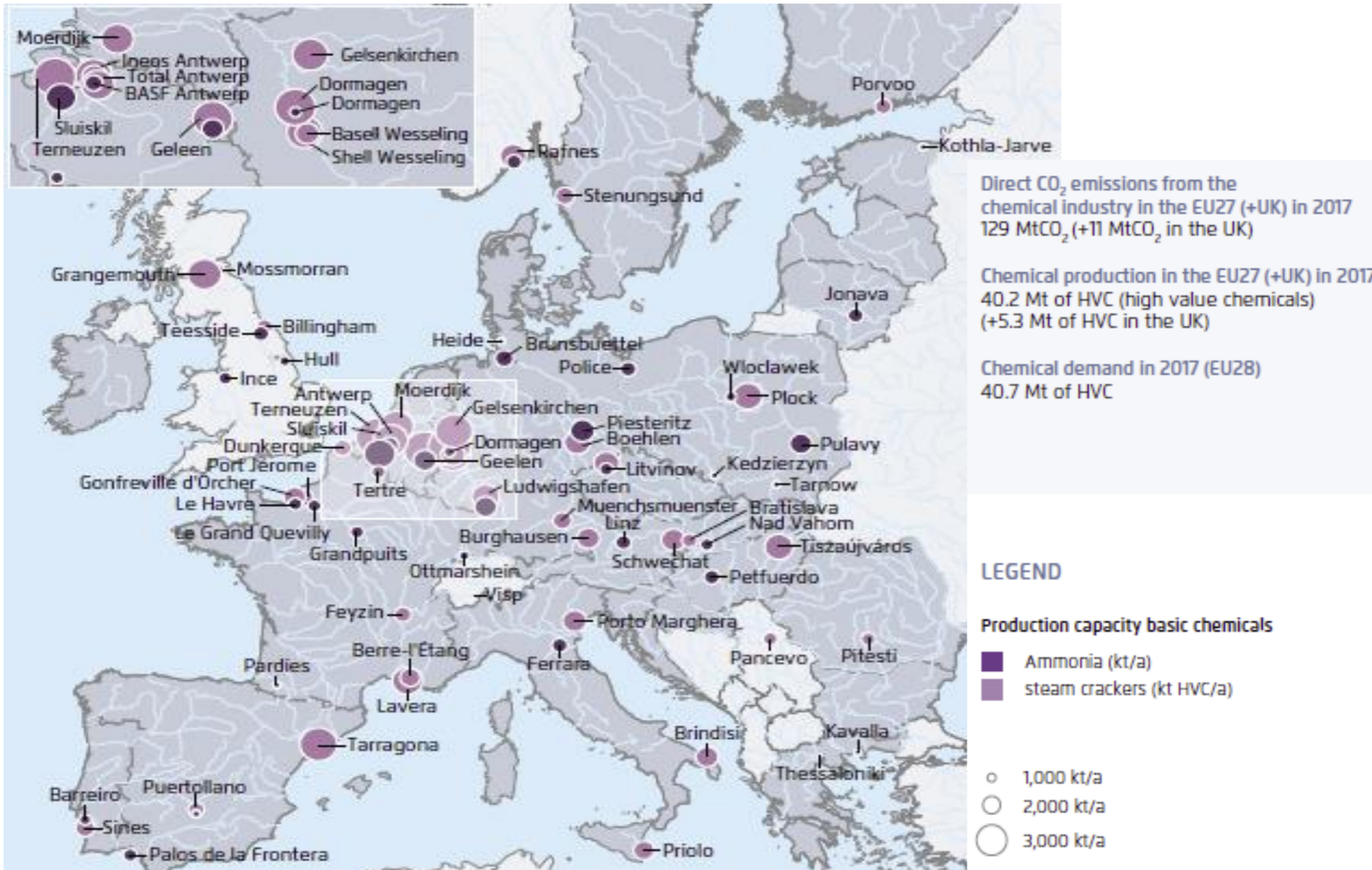
Data for 2018 from dena (2021).

# The European green energy challenge

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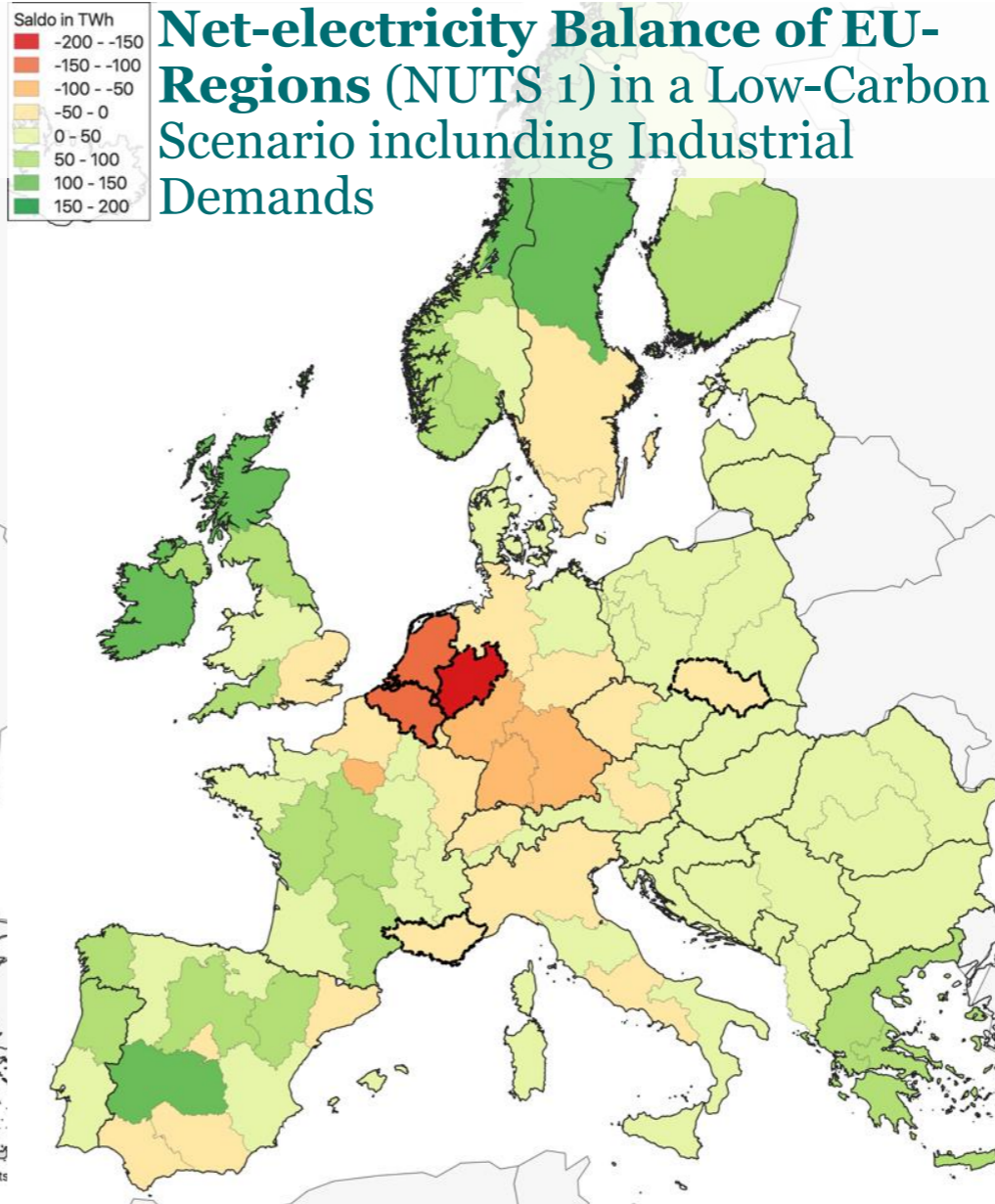
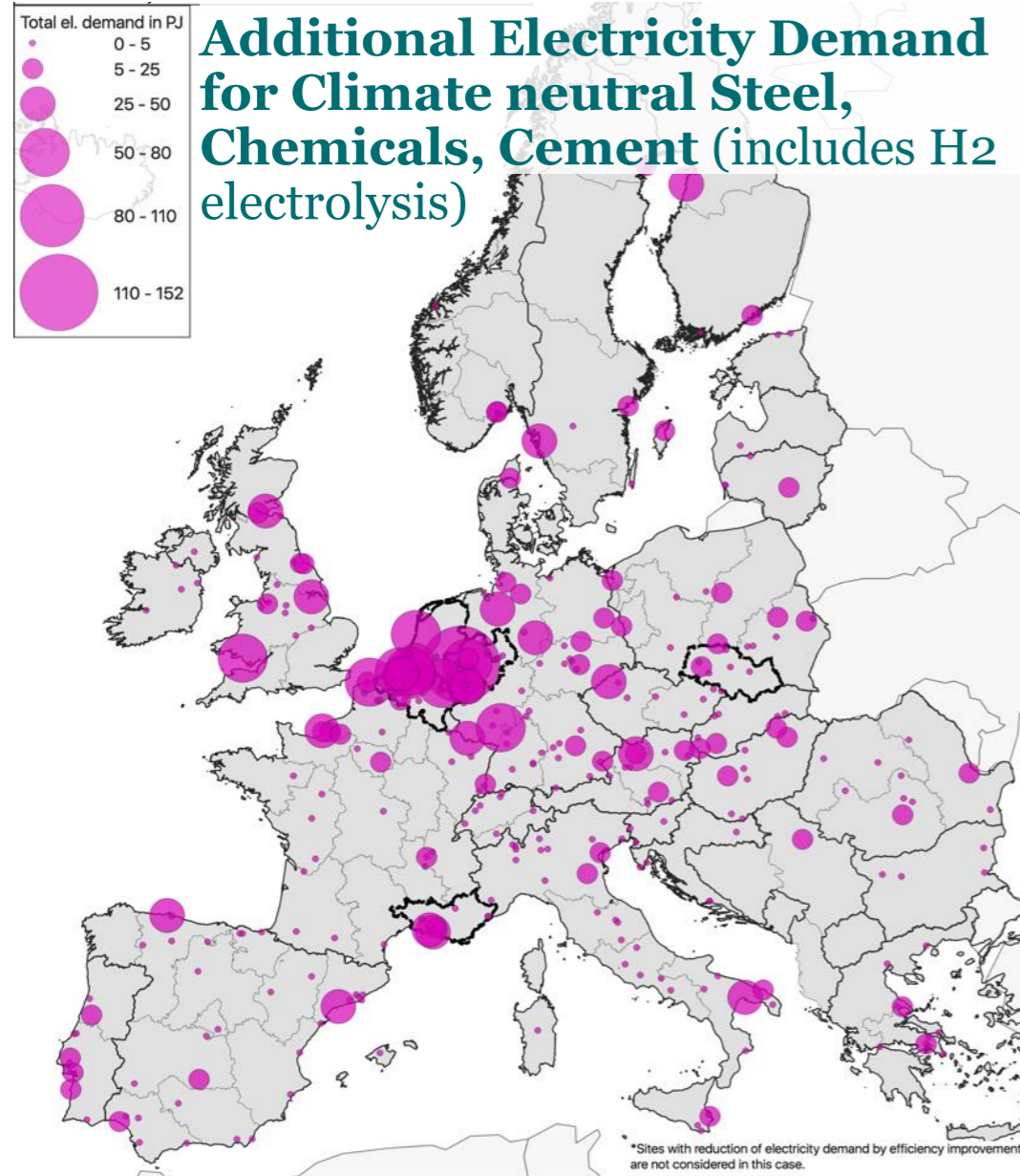
With a focus on petrochemistry

# EU basic chemicals production sites and volumes



- Largest energy user of the industrial sector (energy and non-energy purposes)
- 3<sup>rd</sup> largest emitter of the industrial sector
- Challenge: The sector requires carbon feedstock for its products even in a GHG neutral world

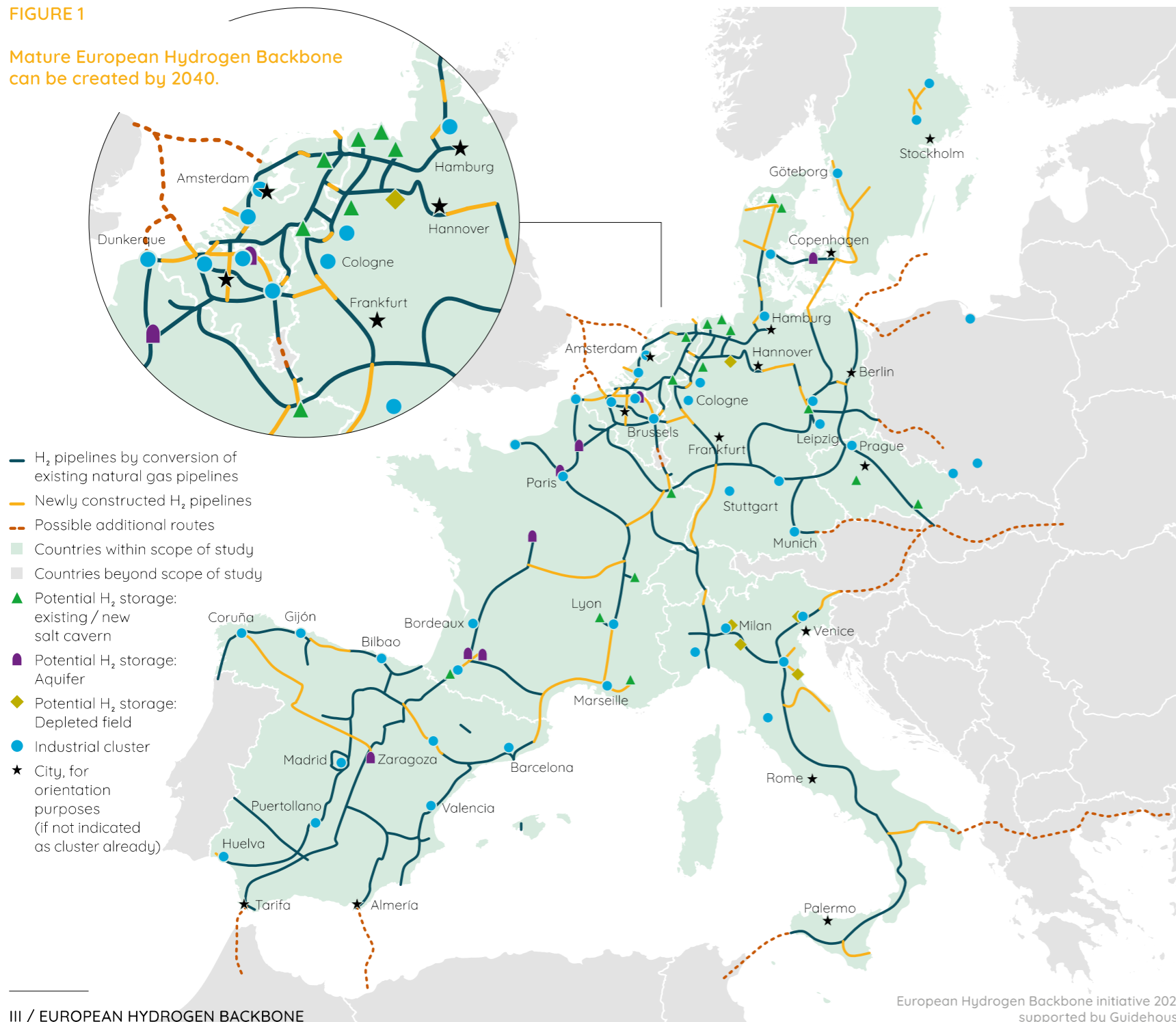
# The backdrop: Electrification and feedstock transition create a huge energy demand hot spot in NWE



- RES-Potentials in the EU could be sufficient for a high share of self supply
- Even in such a scenario NWE will be a demand hot-spot
- Strong and competitive supply chains for clean energy will be crucial
- This might include a massive exploitation of the North Sea

FIGURE 1

Mature European Hydrogen Backbone can be created by 2040.



## European Hydrogen Backbone

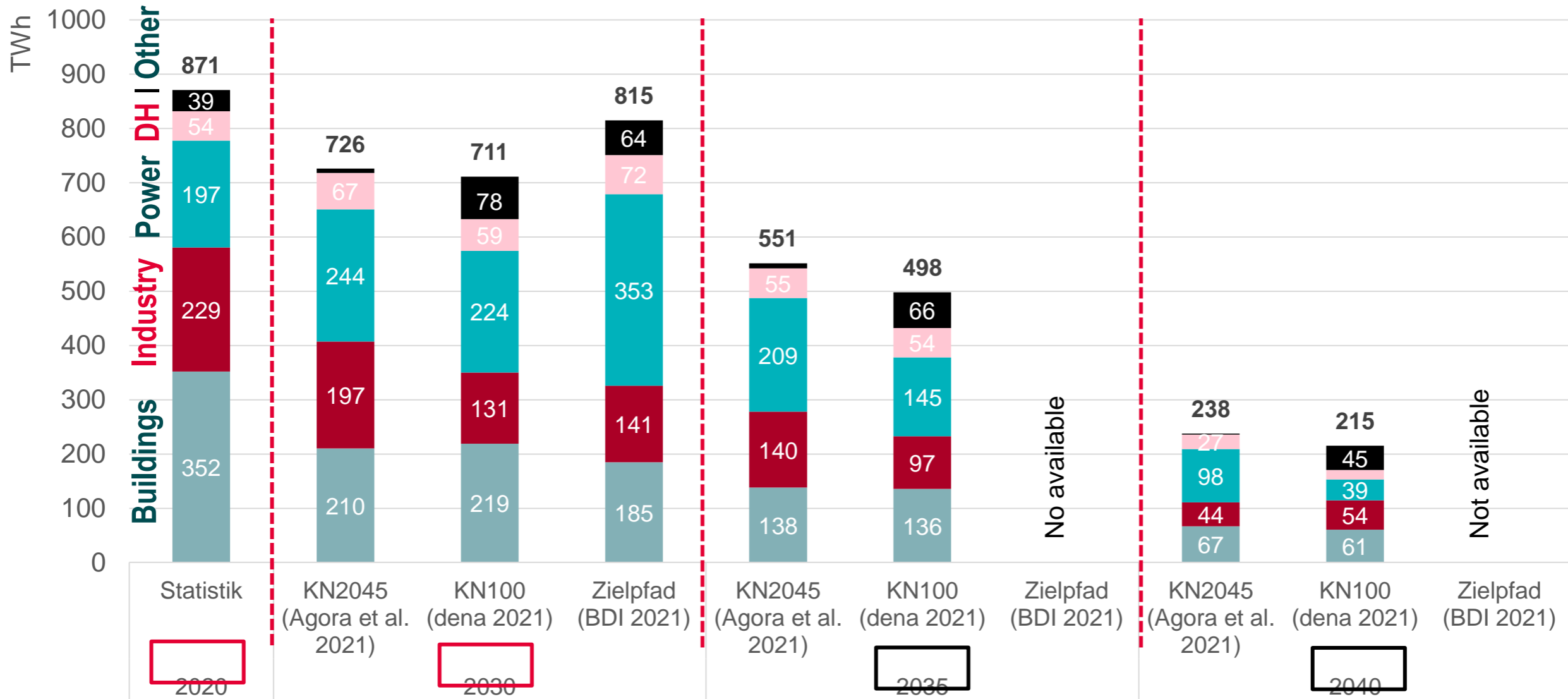
→ A vision by major European gas TSOs

# **New challenge: Speeding up the phase out of natural gas**

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# Natural gas in climate neutrality scenarios, Germany

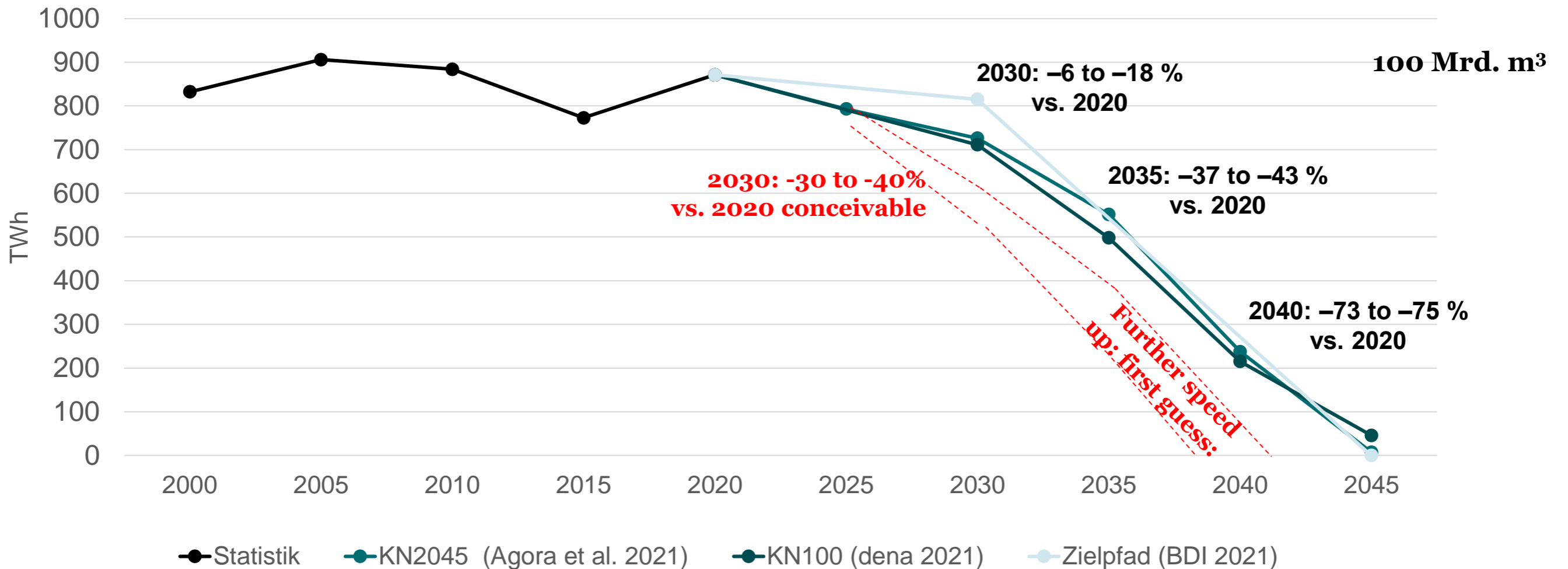


Data partly estimated, including non energetic use

# Natural gas in climate neutrality scenarios, Germany

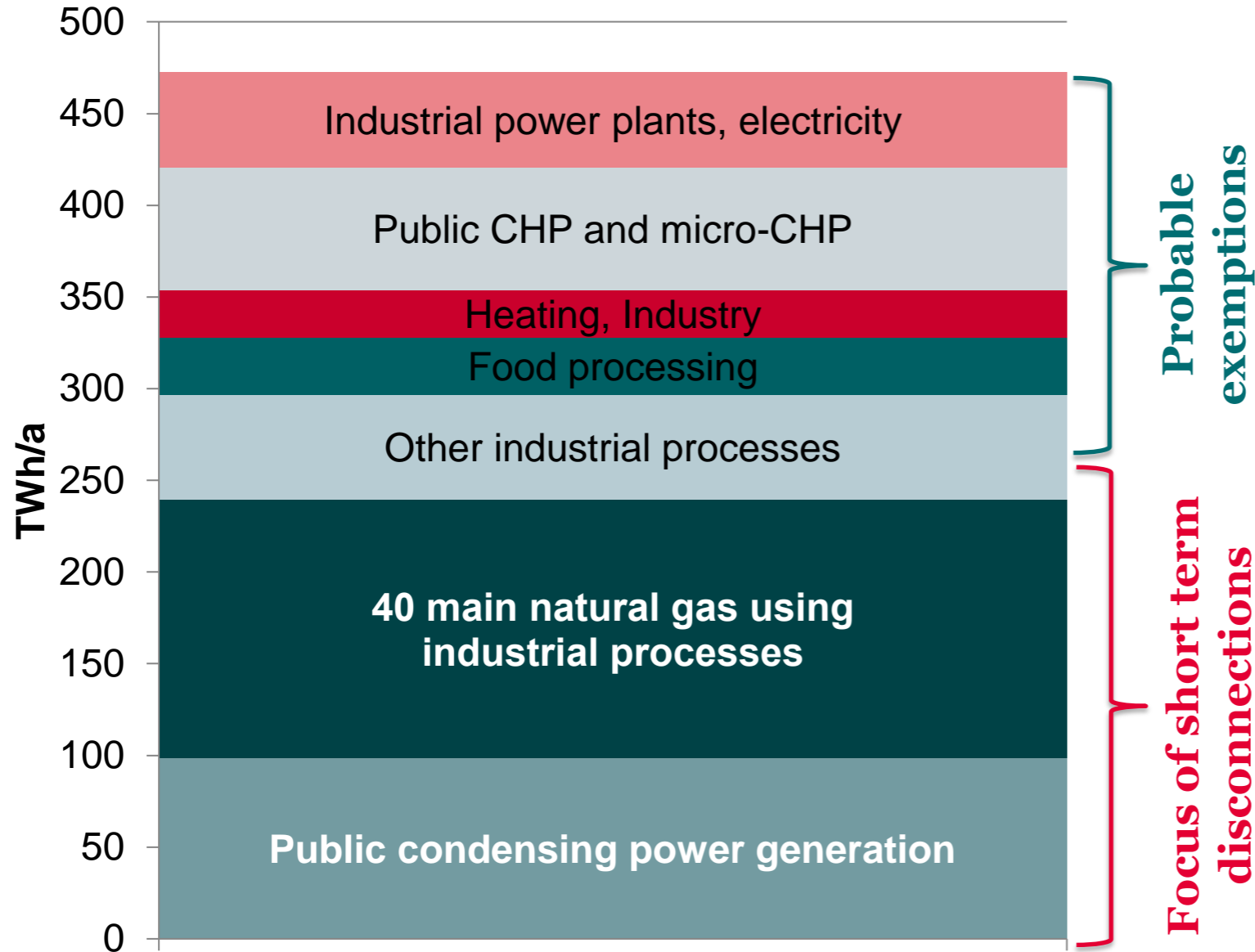
NG phase out was already envisaged from 2030 on

Natural gas demand (primary), all uses



# In an emergency:

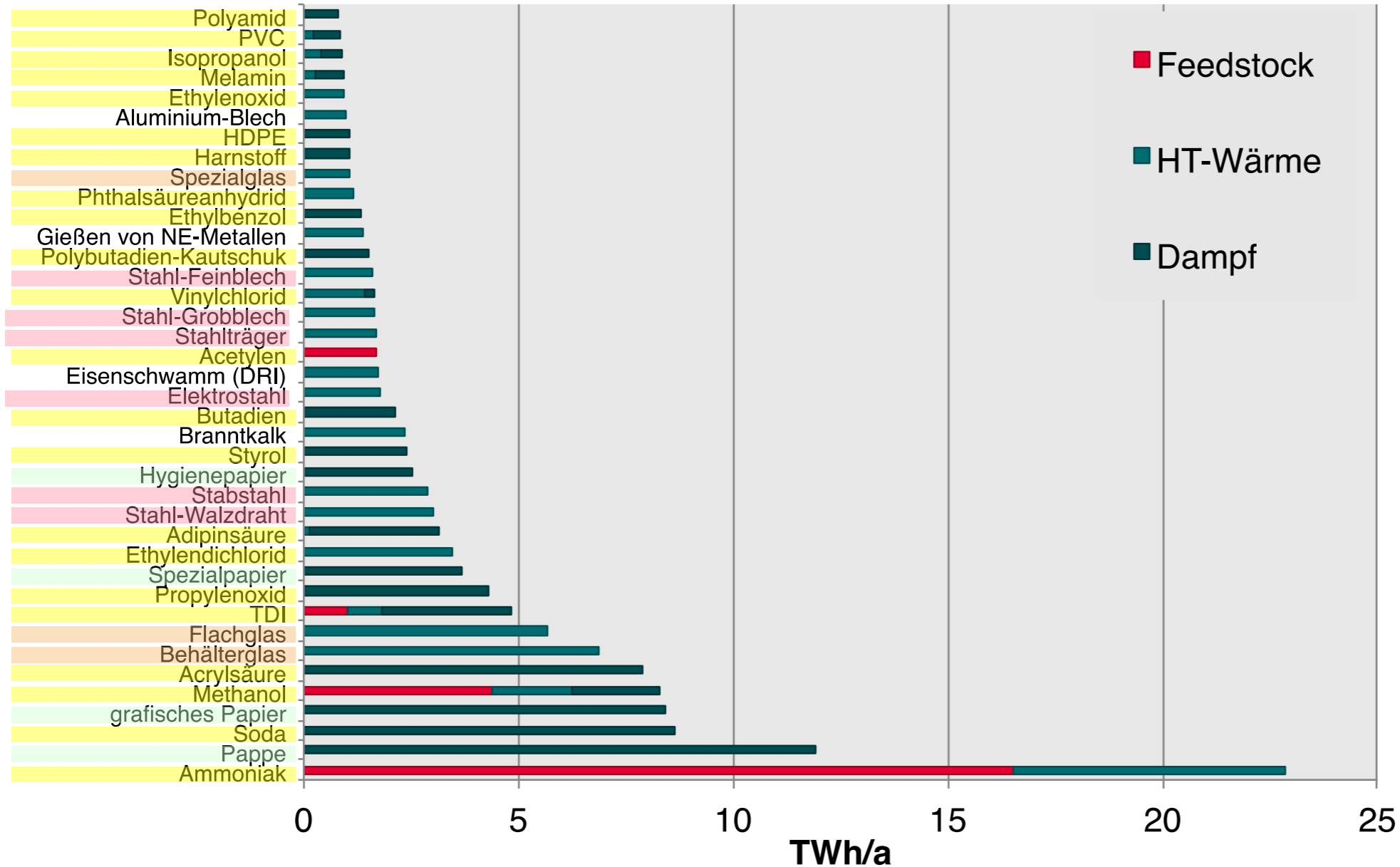
## Where to disconnect NG supply first?



- 400 TWh annual savings would roughly equal current Russian supply (1100 GWh per day)
- Electricity generation and industry are first targets for disconnection (heat sector exempt)
- Public CHP has only limited potential for fuel switching.
- Smaller processes and food processing might be further candidates for exemptions.

# Natural gas in industrial processes in Germany, 2019<sup>\*)</sup>

40 processes consuming about 140 TWh



## ➤ Main sectors

- Basic chemicals
- Paper & carton
- Glass
- Secondary steel making, steel milling and rolling

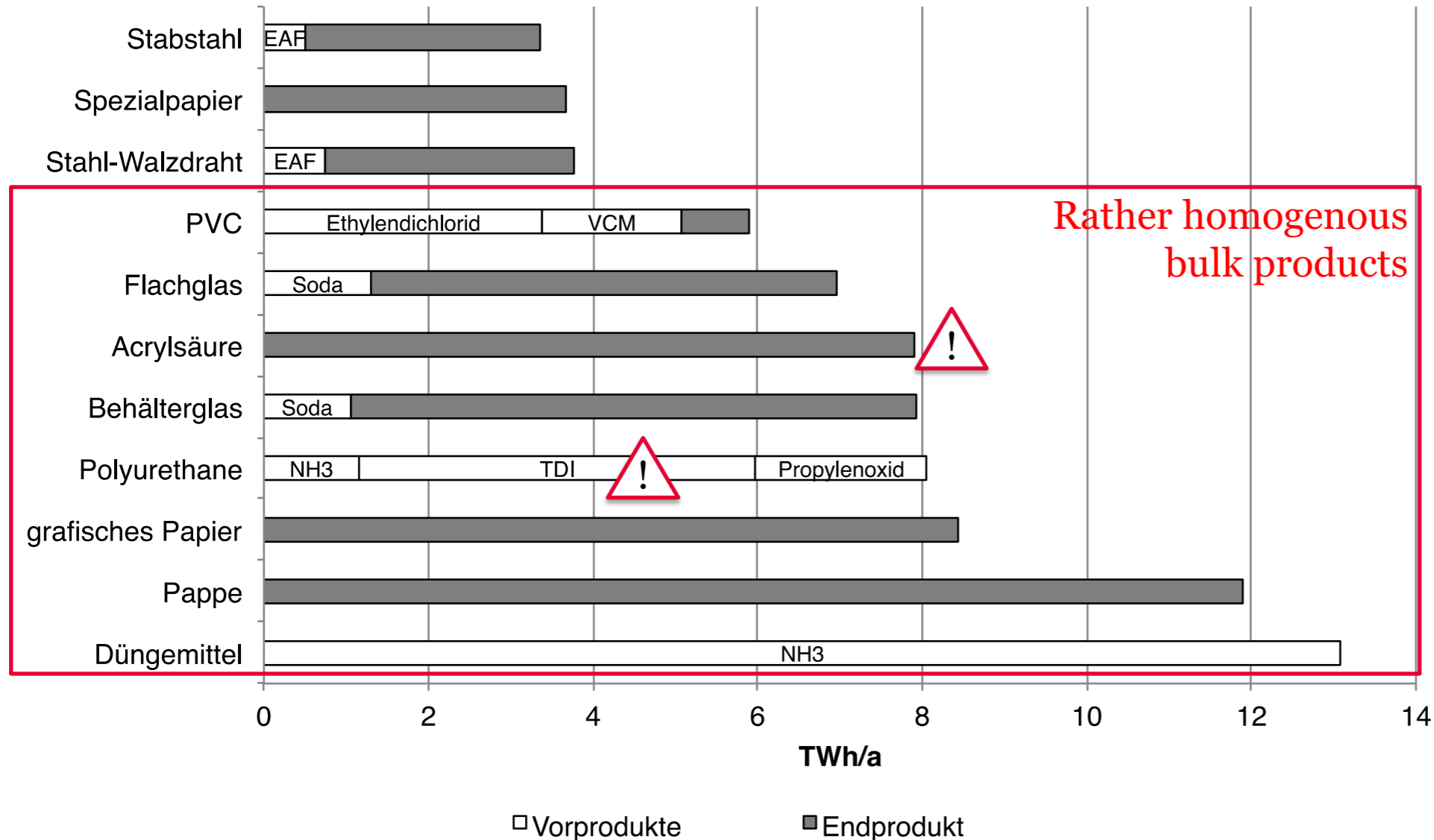
## ➤ Possible criteria for emergency disconnection:

- Fuel switch possible
- Importance of subsequent value chains
- Options to import products

<sup>\*)</sup> estimate, based on production volumes 2019

# Effects of a NG embargo

## A first glance on value chains



Rather homogenous  
bulk products

- ▶ Polyurethane value chain is very important → need to import intermediates (NH<sub>3</sub>, etc.)
- ▶ For other value chains final product imports are more probable
- ▶ Potentially affected industries
  - Agriculture
  - Automobile
  - Building&construction
  - Beverages
  - Packaging/Logistics
  - Printing

# **Conclusion:** Climate neutral industry needs an integrated policy perspective

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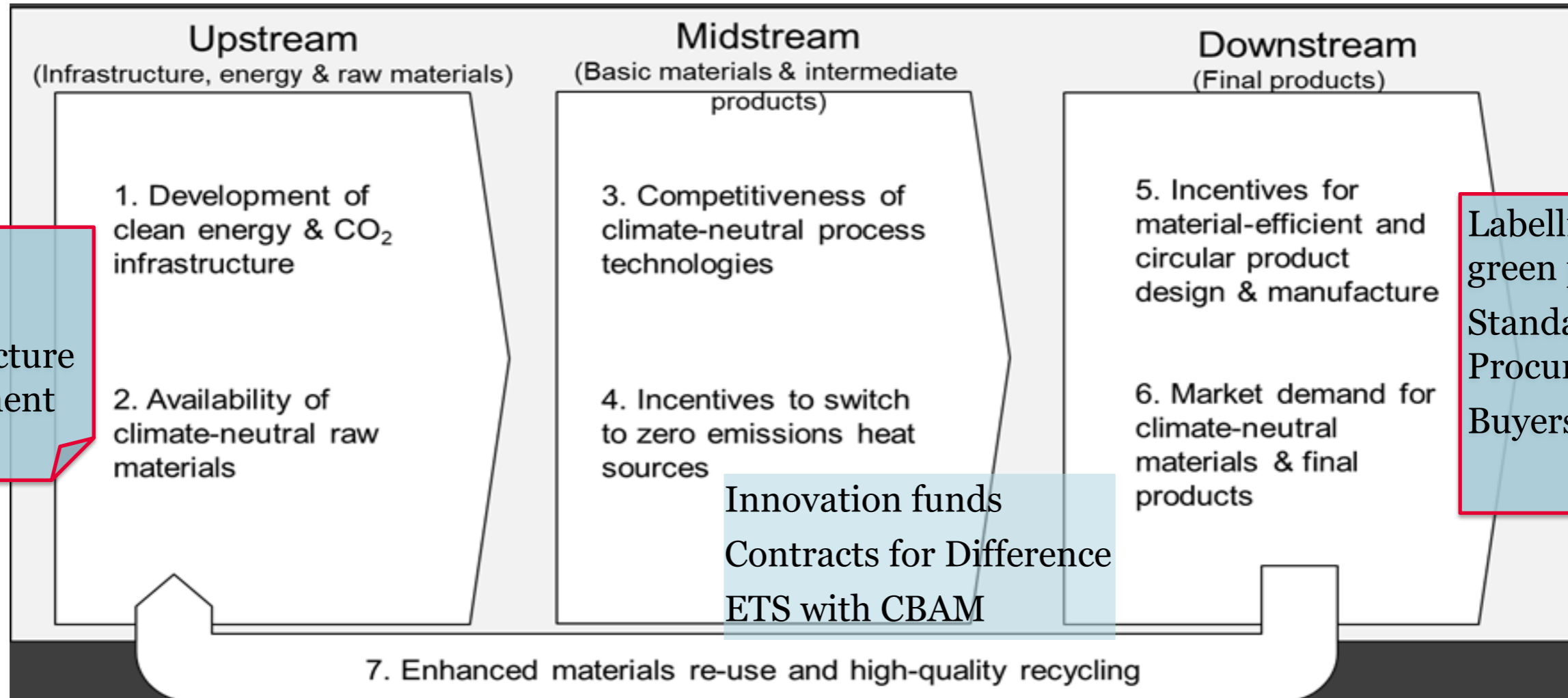
A brief example on necessary policy integration and the potential role of science

The  
reinvestment  
challenge

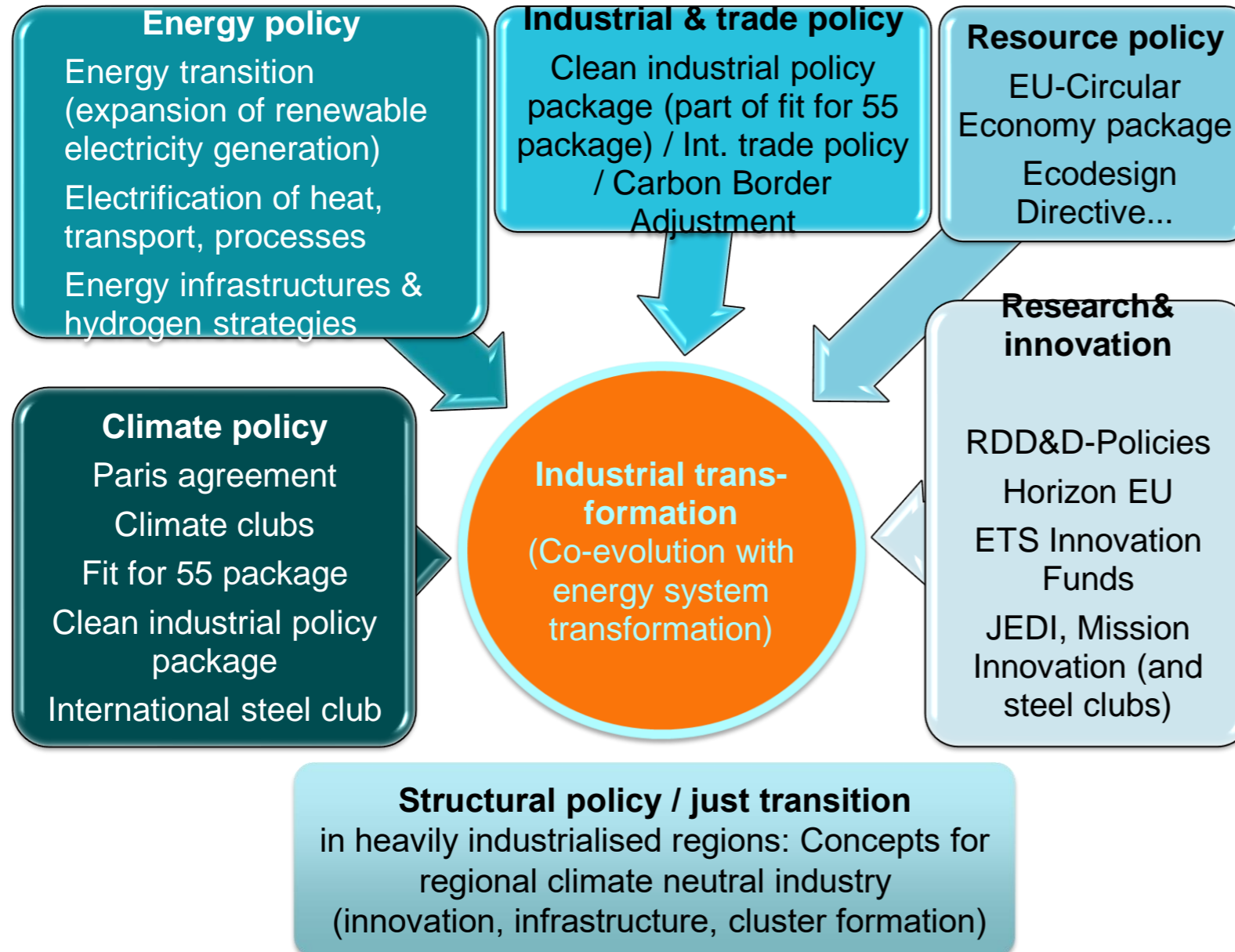
The green  
energy (and  
carbon)  
supply  
challenge

The  
renewables  
pull challenge  
and the  
stability of  
value chains

## Decarbonising energy intensive industries needs a policy package covering the complete value chain







## A new paradigm of a climate and industrial policy

would best be

- *Clearly target oriented* towards sustainability and climate neutrality as core long term targets (→ fit f. 55 pack.)
- *Integrating* policies for climate, energy, innovation and resource efficiency with trade, growth and structural policies (→ fit for 55 package)
- And *creating a new mode of societal cooperation* of all societal stakeholders

# Energy intensive industries as new focus of global climate policy: COP26 Glasgow



**RACE TO RESILIENCE** **RACE TO ZERO**

**Breakthrough:** to make near-zero emission steel the preferred choice in global markets, with efficient use and near-zero emission steel production established and growing in every region by 2030.

**Why?** The global steel industry, which employs more than six million workers, is responsible for 4% of global greenhouse gas emissions. To align with the International Energy Agency's Net Zero pathway, the sector must make a significant shift from coal to electricity in its energy demand use by 2050, from 15% to 70%. To reach the target will require rapid investment and scale-up of innovation, hydrogen and electrification.

**Existing progress the Breakthrough will turbocharge:** seven out of the ten biggest steel-producing countries have initiated at least one green steel project, while nine companies – representing around 20% of global steel production – have set firm net zero emissions commitments. The **Glasgow Breakthrough on Steel** brings together global governments to cooperatively accelerate the innovation and create the economies of scale and incentives for investment needed to rapidly create and deploy the solutions to make near-zero emission steel efficient, widespread, and a growing concern by 2030.

**International collaboration:** we note the importance of the following international initiatives in making progress towards and coordinating activities towards this Breakthrough:

- [Clean Energy Ministerial's Industrial Deep Decarbonisation Initiative](#)
- [Climate Group's SteelZero](#)
- [First Movers Coalition](#)
- [Leadership Group for Industry Transition \(LeadIT\)](#)
- [Mission Innovation Industry Mission](#)
- [Mission Possible Partnership's Net-Zero Steel Initiative](#)
- [Responsible Steel](#)

**Endorsed by:** Australia; Belgium; Canada; Denmark; Egypt; European Union; Guinea Bissau; India; Ireland; Israel; Japan; Lithuania; Luxembourg; Norway; United Kingdom

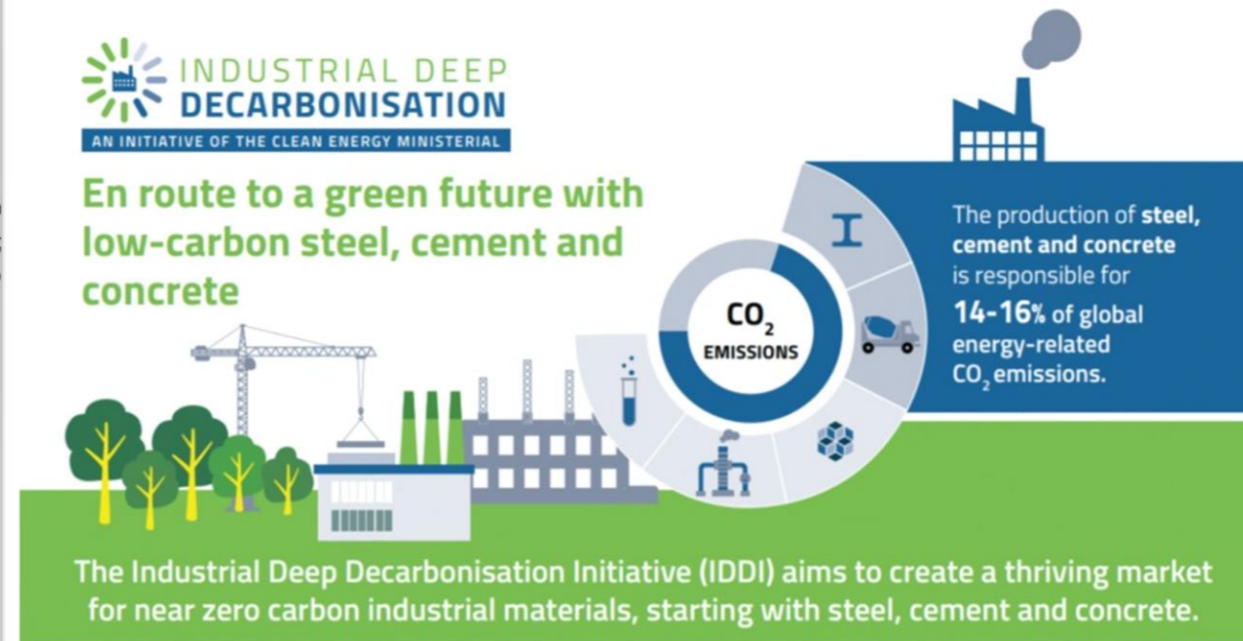


**STEEL**

## World's largest steel and concrete buyers make game-changing push for greener solutions



En route to a green future with low-carbon steel, cement and concrete



Horizon 2020 Societal challenge 5:  
Climate action, environment, resource efficiency  
and raw materials

COP21 RIPPLES – COP21: Results and Implications for  
Pathways and Policies for Low Emissions European Societies

### Exploring the Prospects for a Sectoral Decarbonization Club in the Steel Industry

by Lukas Hermwille

**Thank you!**

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